The effect of transcatheter arterial embolisation for nonvariceal upper gastrointestinal bleeding

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ABSTRACT

INTRODUCTION: The aim of this investigation was to evaluate the clinical efficacy and safety of transcatheter arterial embolisation with coils for nonvariceal upper gastrointestinal (GI) bleeding after failed endoscopic therapy.

MATERIAL AND METHODS: Between 2007 and 2009, transcatheter arterial embolisation was performed in 40 patients. We evaluated the angiographic and clinical success rate, recurrent bleeding rate, procedure-related complications and clinical outcomes.

RESULTS: Primary technical success was achieved in all patients. In 82% of the patients, haemostasis was achieved with clinical improvement and without need for further therapy. There were no ischaemic GI complications. Recurrent bleeding occurred in seven patients (18%) within the first week after treatment, and in three cases these were managed successfully with a second embolisation. The overall 30-day mortality rate was 18%, and mortality related to bleeding was 10%. The mean follow-up period was 13 months (range 1-31 months). Non-bleeding-related mortality was 15% in the follow-up period. There were no hospital readmissions due to upper GI bleeding.

CONCLUSION: Transcatheter arterial embolisation for upper GI bleeding is a safe and effective minimally invasive method, but it entails relatively high rates of early rebleeding as well as relatively high mortality rates both related to GI bleeding and to non-GI bleeding causes.

Upper gastrointestinal (GI) bleeding is defined as bleeding proximal to the ligament of Treitz. Upper GI bleeding has a mortality of approximately 10% [1]. Patients most commonly present with melaena, haematemesis, haematochezia and/or shock [2]. Duodenal and gastric ulcers are the most common reasons for bleeding in adults, followed by tumor and pancreatitis [3]. In most cases (80%), bleeding ceases spontaneously or after therapeutic endoscopy, which is the first-line therapeutic intervention [4]. If therapeutic endoscopy fails, the secondary therapeutic options are surgical or interventional radiological procedures. Surgical intervention is associated with a high mortality reaching 30% in patients with severe comorbidity [4, 5].

We retrospectively analyzed the efficacy and safety of intraarterial embolisation with coils after failed endoscopic therapy in patients with upper GI bleeding.

MATERIAL AND METHODS

All patients who had undergone angiographic embolisation after unsuccessful endoscopic haemostasis for upper GI bleeding from January 2007 to August 2009 at Odense University Hospital, Denmark, were retrospectively analyzed on the basis of material from radiological and clinical databases. Data was collected on patient demographics, primary disease, comorbidity, procedure-related complications, clinical success and mortality (**Table 1**). Clinical success was defined as cessation of bleeding with stable haemodynamic parameters. Rebleeding was assessed by perusing clinical parameters (clearing of aspirate from the nasogastric tube, no blood in stool and haematologic/haemodynamic parameters). Standard transfemoral catheterisation was performed. All patients underwent abdominal aortography and selective angiography of the celiac trunk and superior mesenteric artery. This was followed by superselective angiography of the gastroduodenal artery, the left gastric artery as well as the superior mesenteric artery branches, where necessary. Extravasation of contrast media and/or presence of arterial pseudoaneurysm indicated bleeding, and embolisation was subsequently performed with the use of microcoils delivered through microcatheters. In a few cases, additional embolisation with polyvinyl alcohol microparticles was performed. In case of aberrant arterial supply, embolisation of the other vessels was also performed. In cases without obviously bleeding vessels according to angiography, "blind" embolisation was performed based on endoscopic findings of ulcer, visible actual bleeding or blood clot. Furthermore, a vessel which has formerly bled will often appear spastic.

Hospital admission due to GI re-bleeding was noted at follow-up as was mortality.

RESULTS

A total of 40 patients underwent embolisation procedures with 100% primary technical success. The patient population comprised 26 men and 14 women. The mean

TABLE 1

Procedural and outcome dates.

Technical success, %	100
Clinical success, %	82
Embolised arteria gastroduodenalis, %	90
Additionally embolised arteria pancreaticoduodenalis inferior, %	9
One case of additional PVC embolisation , %	3
Embolised arteria gastrica sinistra, %	5
Embolised arteria lienalis , %	5
"Blind" embolisation, %	57
Extravasation of contrast-angiographical bleeding, %	38
Pseudoaneurysm of arteria gastroduodenalis, %	5
Inadvertent embolisation/ischaemic complications, %	5
Early rebleeding rate, %	18
Mortality, bleeding-related, %	10
Follow-up, months (range)	13 (1-31)
Non-bleeding mortality rate in follow-up period, %	15

age was 67.4 years (range: 31-92 years). The bleeding causes were duodenal ulcer in 21 patients (52%), gastric ulcer in eight patients (20%), complicated pancreatitis in seven patients (18%) and pancreatic carcinoma in four patients (10%). Comorbid conditions were respiratory in eight patients (28%), cardiovascular in five patients (17%), malignant diseases in two patients (7%), renal failure in three patients (10%), coagulopathy in eight patients (28%) and multiorgan failure in three patients (10%). The gastroduodenal artery was embolised in 36 cases (90%) with coils. In nine cases angiography of the superior mesenteric artery also revealed back-bleeding from the inferior pancreatico-duodenal artery which was also embolised to achieve complete angiographic haemostasis. In one patient, embolisation of the gastroduodenal artery was performed from the superior mesenteric artery because the coeliac trunk had a severe stenosis. In another case, additional microparticles were injected to achieve complete haemostasis. The left gastric artery was embolised in two cases (5%). The splenic artery was embolised in two cases (5%). In all patients angiographic cessation of the bleeding was achieved. In 23 patients (57%), "blind" embolisation was performed. In 15 patients (38%), it was possible to visualize the bleeding artery by angiography (extravasation of contrast) (**Figure 1**, and **Figure 2**). In two patients (5%), pseudoaneurysms of the gastroduodenal artery were found. There were two cases (5%) of clinically insignificant inadvertent dislocation of coils distally into hepatic and splenic arteries. No other complications were related to the intervention. Clinical success was achieved in 33 patients (82%). Seven patients (18%) had early re-bleeding within 4.2 days (range: 1 – 11 days). A second transcatheter embolisation was performed in three of these patients with clinical

success. In the remaining four patients, haemostasis was not achieved. The repeat angiographies revealed that previously embolised arteries were non-bleeding, but other vessels were the causes of rebleeding. Thirty-three patients (82%) were discharged after clinical recovery without further surgical or interventional therapy. Four patients (10%) died during hospital stay due to continuous GI bleeding. The mean follow-up period was 13 months (range: 1-31 months). At follow-up there was no clinical suspicion of GI ischaemia in any of the patients. In the group with clinical success, five patients died (15%) from non-bleeding related diseases: prostate carcinoma (n = 1) cholangiocarcinoma (n = 1), cardiac failure (n = 2) and hepatic failure (n = 1) in the follow-up period.
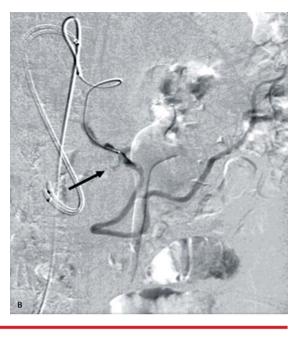
DISCUSSION

Since the first transcatheter embolisation for upper GI bleeding in 1972 [6], interventional treatment has become a viable therapeutic option in patients with failed endoscopic haemostasis. The introduction of microcatheters and superselective embolisation leads to fewer procedure-related complications [4, 5, 7]. Selective distal catheterisation can be limited by vessel tortuosity, bowel peristaltic and vessel vasospasms inducted by the catheter and by guidewire manipulations. Vasospasms may provoke bleeding arrest [1, 3]. We used microcatheters and achieved a 100% primary technical success without significant vasospasms or vessel anatomy limitations. Some authors use a vasodilatator and catheter withdrawal to resolve vasospasms. The intermittent nature of GI bleeding is a well-known fact and it can therefore be quite challenging to make site-specific diagnoses. Angiographic confirmation of bleeding is therefore not a prerequisite for endovascular therapy. Scintigraphy is a diagnostic method with a relatively high sensitivity, but it is not suitable for haemodynamically instable patients and it is only available during the daytime. After failed endoscopy at our institution, patients are referred to angiographic diagnosis and intervention without additional diagnostic procedures. We have a relatively high rate of "blind embolisations" without angiographic confirmation of contrast extravasation. The total clinical improvement after embolisation of all patients with upper GI bleedings achieved in the present study supports our decision also to perform "blind" embolisations based on clinical and endoscopic findings. Some authors have not been able to demonstrate a good correlation between "blind" embolisation and clinical outcome [10]. In 82% of the embolised cases in the present study, clinical improvement was observed and there was no need for further haemodynamic treatment. Early rebleeding rates were relatively high (seven patients, 18%). Successful repeat embolisation with

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FIGURE 1

A. Selective angiography of truncus coeliacus showing a spastic gastroduodenal artery without extravasations of contrast (active bleeding).
B. Superselective angiography of gastroduodenal artery showing an active bleeding (arrow shows contrast extravasations).
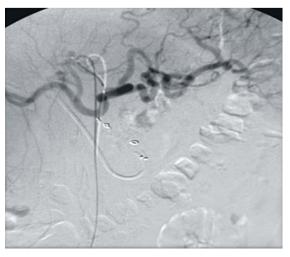

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good clinical outcome was performed in three patients (43%). Four patients (57%) experienced no clinical improvement. Collateral flow was the cause of rebleeding in all our cases. No cases of recanalisation of previously embolised arteries were found. Eleven articles published since 1984, comprising 549 patients, have demonstrated a high technical success rate, but they have also reported a relatively high rebleeding rate, especially in patients with coagulopathy [4, 12]. No clinical ischaemic complications during hospital stay or follow-up were found. Reported rates of major ischaemic complications after embolisation range from 0% to 16% despite rich collateral blood supply; and in case of terminal vessel embolisation, complication rates reach 25% [4, 11]. The fact that only two inadvertent, clinically insignificant cases of embolisation of the hepatic and splenic arteries have been reported indicates that embolisation is, indeed, a safe procedure. Mortality related to bleeding occurred in 10% of the patients, 8% of the patients died due to comorbidity, and, thus, the total 30-day mortality was 18%. We observed a high rate of non-GI bleeding-related mortality in the follow-up period (up to 15%). Treatment of these groups of patients is challenging because, in addition to the bleeding, severe comorbid conditions contribute to poor outcomes. Surgery is associated with the same problem and with even higher mortality rates. In a retrospective analysis, Erikson described statistically significant 30-day mortality rates in surgery patients of 14% compared with 4% in endovascularly treated patients. He found that in the majority of cases treated surgically and endovascularly, angiographic embolisation could be repeated with a high rate of secondary clinical success [13]. No prospective comparative studies on angiographic embolisation versus surgery have yet been performed. On the basis of retrospective data, no significant differences seem to exist between the occurrence of recurrent bleeding in the embolised group of patients (29%) and the surgery group (23.1%) [4, 14].

FIGURE 2

Control angiography with arrest of bleeding and occlusion of gastroduodenal artery.

CONCLUSION

Transcatheter embolisation is a safe and effective procedure, but its use is limited because of relatively high early rates of rebleeding and high mortality, both of which are associated with GI bleeding and non-GI related mortality causes. Transcatheter arterial embolisation is a valuable method in the treatment of early rebleeding and involves no high risk of ischaemic complications. A multidisciplinary approach is necessary in the treatment of these patients and should comprise gastroenterologists, interventional radiologists, anesthesiologists and surgeons to achieve the best possible results.

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